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Finally this report makes very evident the need for further investigation in regard to such important points as the best varieties of cane, and the possibility of their improvement by selection and crossing, the most suitable soil for sorghum, the effect of fertilizers on its growth and content of sugar, the methods of extracting the sugar from the cane, and the prevention of losses in the further treatment of the juice. In a word, while sugar can be made from sorghum, it yet remains to be seen how economically it can be manufactured, and how completely the great waste involved in the present crude processes can be avoided; and the committee closes its report by urging upon the U. S. department of agriculture especially, the duty of continuing the investigations which have already yielded such important results.

HANN'S CLIMATOLOGY.

Handbuch der klimatologie. Von Dr. JULIUS HANN. Stuttgart, J. Engelhorn, 1883. (Bibliothek geographischer handbücher.) 10 + 764 p. 8°.

THERE are many treatises upon the subject of climate. The larger number of these are devoted to the consideration of the special characteristics of the climate of some particular country, and contain numerous statistics derived from meteorological observations, together with a description of the prevailing weather conditions. A few discuss the subject from a broader stand-point, and take account of the general conditions which prevail over a large area, with their causes and modifications. The treatise before us, however, differs from its predecessors in its aim as well as in its execution. It is designed to give a view of climatology as the result of certain forces which are at work in nature, and to investigate the result of the operations of these forces as they are exhibited in the climate of the world. Its author is the acknowledged head of meteorological science in Austria, — one who has done much to place meteorology on a scientific basis, and who is especially qualified to speak with authority upon the subjects which he treats, on account of his well-known familiarity with the current work of other investigators, and his ability as a critic. It is to be expected that a work written by such an author will be comprehensive, thorough, and masterly, that it will indicate the present condition of the subject from a scientific stand-point, and be as accurate as the best data at hand can make it. All these conditions are fulfilled and abundantly satisfied in the work before us.

The aim of the treatise is to present a comprehensive view of climatology. First the word is defined, its object specified, and the various climatic factors mentioned, briefly discussed, and illustrated. After this introduction, which is, in fact, a concise treatise upon the subject of climatic statistics rather than a simple introduction, the author proceeds to treat the subject in two divisions, — general and special climatology. Under the former head are considered, 1°, 'solar climate,' or that which would result directly from solar radiation; then, 2°, the modifications introduced by atmospheric and terrestrial conditions, resulting in climate as actually existent. Under the latter head are considered the special climatic characteristics of different portions of the globe, with copious illustrations. In carrying out this plan, the author treats the various topics with conciseness but with singular clearness, and advances in logical progression without dwelling too much on the minor details, or retarding the course of thought by discussing the many collateral subjects which are naturally suggested. In a few instances, where a controverted subject is discussed in the text, an elaborate footnote is devoted to a defence of the author's position, or a statement of the dissenting opinions of others; and several appendices contain fuller explanations of the special topics touched upon in the main portion of the treatise. In this way the author preserves the unity of the work, and at the same time calls attention to important considerations to which he cannot give much space in the body of the treatise. The work is not exhaustive: indeed, that would be impossible in so comprehensive a subject. In many cases it does not enter into the details of an investigation, but gives the results obtained without discussing the methods of investigation employed.

At the outset the author carefully defines the word 'climatology,' and shows the relation between climatology and meteorology. By climate is to be understood the average weather conditions of different places on the earth's surface, together with the extent of the deviations from the average conditions. The climatologist, in treating the causes of climate, necessarily makes use of the laws which the meteorologist in his broader study of atmospheric phenomena has deduced, and, in turn, furnishes the latter with facts which he must account for by the meteorological principles he has established. The two sciences are therefore intimately connected; and we may, if we wish, regard climatology as a part of the

science of meteorology, which takes into account the phenomena included in the latter only in so far as they affect the well-being of living creatures on the earth. It is well to establish a definite position for climatology; and the author is wise in restricting it to average weather conditions, and deviations from the average, for these are the controlling influences which determine the relations of any place to animal life. The important climatic factors are temperature, moisture, cloudiness, wind, atmospheric pressure, evaporation and the chemical composition of the air, mentioned nearly in the order of relative importance; temperature, rainfall, and wind being usually given as the three essential factors. These factors are not independent, and are so mutually connected (as, e.g., cloudiness and temperature) that they cannot be discussed separately. Atmospheric electricity is recognized as important, but needing further study before it can be classed as a factor. It would seem as if a similar reason would have prevented the insertion of the composition of the air in the list of factors; for the relation of the chemical constituents in their varying proportions to animal life is confessedly obscure. In the discussion of these factors, those special features with regard to each are mentioned which would be useful in representing statistically the climate of a place. Especial prominence is given to temperature statistics; and eight different subjects are named which deserve representation in tables, such as the monthly and annual means, magnitude of daily ranges, etc. An important omission in the tables usually given is pointed out; viz., some expression for the rapidity of temperature changes. The author suggests two ways in which this can be done,—1°, by the difference between consecutive daily means, and, 2°, by the rapidity of changes in some adopted period of time. These and other suggestions can be profitably considered by those who have charge of the preparation of weather statistics: they should be presented in such a shape as to enable any one to readily obtain the facts as to the climate of any place for which he consults them. The statistics of Vienna are presented in illustration of the subject.

The section devoted to general climatology is of special value. Quite properly, it begins with a discussion of climate as dependent upon the distribution of solar heat, and thus includes the results of investigations in solar radiation. Disregarding for the time the effect of the atmosphere, the distribution of solar heat is treated as dependent upon the sun's altitude,

the length of the day, and the distance between the earth and the sun. The combined effect of these elements is seen in different latitudes and in the two hemispheres, and is the basis of actual climate. The effect of the atmosphere in modifying these results is next considered, and the subjects of atmospheric absorption, diffusion, and reflection treated. For the sake of comparison, the relative effects on light, heat, and chemical power, are considered, though that relating to heat alone properly comes into consideration. The little knowledge which we possess on these subjects is the cause of the somewhat meagre presentation which the author gives. Coming finally to the further modifications in the distribution of solar heat due to the earth itself, the characteristics of insular, continental, and mountain climate are pointed out, and the effect of marine and aerial currents noted. In this way the author arrives at the actual climate which prevails over the earth, having started with its prime source, the sun. The discussion throughout is general, but is very suggestive of further study by the reader, in the different topics treated. The author quotes extensively from the works of others, and gives copious illustrations. It would be a great help to the student, however, if, as has been elsewhere suggested, references to the works themselves were given, in addition to the names of the authors, which are always carefully mentioned. This section could be expanded into a larger treatise, and may serve with advantage as the basis of extended research, or as a help to class instruction.

The section devoted to special climatology occupies two-thirds of the whole work. After an introduction upon the division of the earth into climatic zones, the author considers the observed climate in each zone, quoting extensively from the publications which describe the prevailing conditions in each country, giving numerous tables, and summing up under each zone its general characteristics. In this section we have, therefore, a compendium of accessible statistics covering the whole world, given in as much detail as the generous limits of the work will allow, and combined with carefully prepared summaries. In order to judge of the excellence of this section, it is only necessary to note how thoroughly the different countries are treated, whether the selections made for illustration are typical or not, and whether the author has made use of the most reliable publications. In all these respects it will be found that the work before us excels. Thus, in describing the climate of North America, the author first gives a statement of

the topography of the country, and the important distinctions in climate which result therefrom; then, passing to the climatic factors, he describes in detail the temperature, rainfall, humidity, cloudiness, pressure, and winds as they exist in the different sections, and illustrates principally from the publications of Schott, Woeikoff, Blodgett, Loomis, Coffin, Dall, Gannett, Whitney, and the signal-service. Not content with general characteristics, he further specifies peculiarities, such as the suddenness of temperature changes in certain localities, tornadoes, northerners, and Indian summer, with appropriate quotations from various writers; and he also appends special descriptions of the climate of Illinois, Lake Superior, the Mississippi valley, Canada, Manitoba, Hudson's Bay, Alaska, the plateau region, Colorado, California, Arizona, and the Bermudas. The climate conditions of other countries are treated with similar thoroughness, making the whole valuable for reference, while its chief merit lies in the running descriptions and summaries. A defect in the work is the lack of charts illustrating the various data. A few only are given; the main reliance for illustration being in the statistical tables, which are almost unnecessarily abundant. Graphic representations are always specially valuable to the reader, and their addition to the work would be a real improvement. It would also have been well to mention the analytical method of representing data, as well as the statistical and graphical; for, while its use is limited, it will surely grow in favor with the advance of the science.

The work of Dr. Hann represents the latest investigations, and is brought down almost to the very date of publication. It will therefore not be soon superseded; and, while additional data will accumulate in coming years, the general discussions will require but little alteration. The work is recommended for the general reader, not to be read in course, but by proper

selection. The general chapters and the summaries contain a large amount of information, for which the details and illustrations can be obtained from the accompanying pages. The student will find the work useful in calling attention to the authorities in each subject. Especially in the section on general climatology, where such topics as solar radiation and atmospheric absorption are, from the design of the work, treated in a general way only, will be found quotations from the publications of the latest investigators. It would be well, too, if the treatment of the subject of climatic factors should call attention to the need of publishing statistics in such a way as to be useful for reference. In this country particularly, we need to give consideration to this subject. There is scarcely an allusion made in the work under review to recent meteorological work in the United States, not because it has not been published, but because it has not been issued in a suitable form. In order to compare our statistics with those of other countries, it is necessary first to re-arrange and classify them. The international meteorological committee has recommended forms of publication, the adoption of which will add greatly to the facility with which corresponding data can be compared. But even these forms do not give all the data which the climatologist would like to have; and meteorological observations could be made more available for studies in climate by attention to the author's treatment of the subject. There is also need of deducing more results from the immense collection of data which is daily accumulating all over the world, to check the prevailing tendency of heaping up observations for no useful purpose. If this work shall have the effect of stimulating research, and promoting a more intelligent use of meteorological observations, it will do much good. It is to be hoped that it will be translated into English to reach a wider circle of readers.

RECENT PROCEEDINGS OF SCIENTIFIC SOCIETIES.

Ottawa field-naturalists' club, Canada.

Jan. 31. — Mr. W. L. Scott read the report of the ornithological and oölogical branch, showing that a number of rare birds had been secured, that thirteen species had been added to the published lists, and that other good work had been done. Among specimens exhibited was a great white egret, in full breeding-plumage, which had been shot on the Upper Ottawa, — a locality far north of its usual range, but where it is stated to be a not uncommon visitor. Its

name, however, will not appear in the lists of the club, as the locality is considered beyond the limits of its district.

Prof. J. Macoun read a practical paper on the 'Edible and poisonous fungi' of the vicinity. He pointed out, that while at present the only fungus collected for food is the common mushroom, *Agaricus campestris*, there are other equally nutritious and palatable forms which exist in far greater abundance; as, for instance, *Coprinus comatus*, which grows in great profusion about the city during Sep-